EEPROM Eraser

V_{pp} instead of UV light

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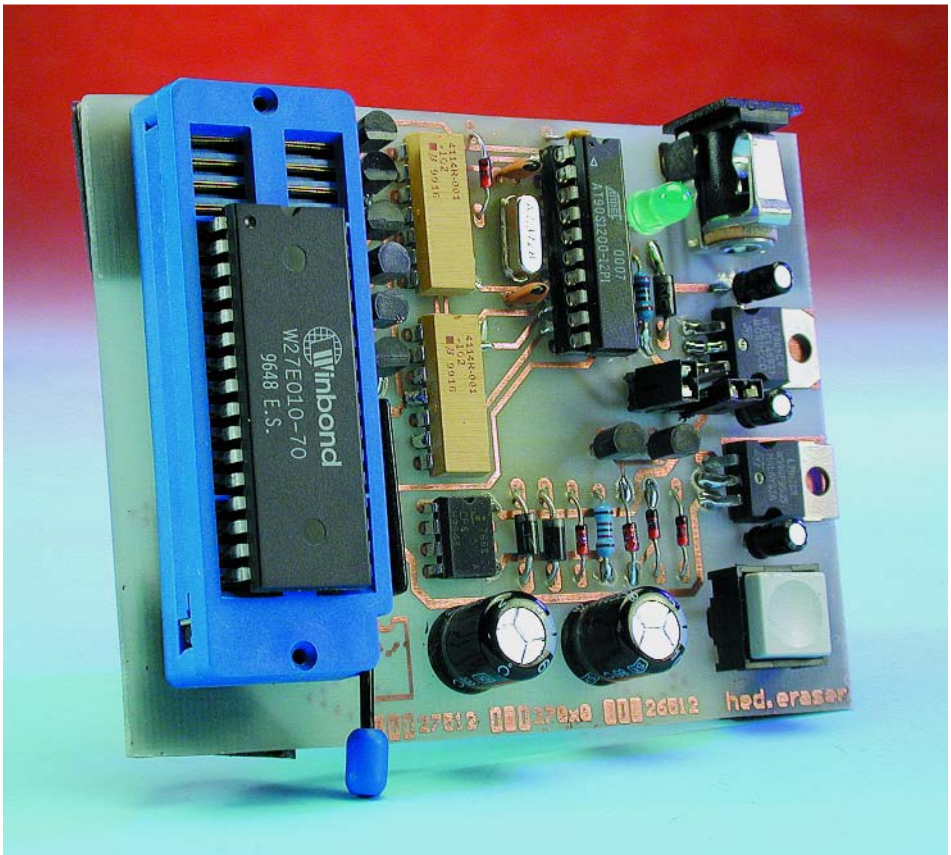
Although you will stumble over programmers for EEPROMs, matching eraser units are few and far between. The small ‘hed.eraser’ solves the problem quickly and efficiently.



Even after more than ten years, various Flash technologies have failed to completely supplant EPROMs. This is surprising because erasing an EPROM using a dose of UV light is tedious, while the glass window in the housing of EPROMs adds considerably to the device manufacturing cost. The Electrically erasable EPROM (EEPROM) is an attractive alternative. Just like the EPROM, it can be ‘burned’ in traditional programmer systems. Moreover, it is 100% electrically compatible with UV erasable counterparts. However, not all programming systems for EPROMs are capable of actually erasing an EEPROM, and that is why such a tool is presented in this article.

The EEPROM Eraser from HED, Germany is not a regular Elektor project in that it is only available from the authors, either as a ready-built unit or as a kit (see inset).

Erasure algorithm

An EEPROM is erased by applying a number of different voltages to different pins, and in a specific order! The algorithm itself is not complicated and consists of the following steps:

1. Apply 5-V supply voltage;
2. pull $\overline{CE}$, $\overline{OE}$ and $\overline{PGM}$ to +5 V;
3. apply programming voltage to A9 and V_{pp} pins;
4. apply erasure pulse to $\overline{CE}$ or $\overline{PCM}$;
5. switch off programming voltage;
6. switch off supply voltage.

Circuit description

An inexpensive, small, microcontroller from Atmel ensures the correct sequencing of signals while observing the required pulse durations. A couple of jumpers are used to set up the configuration required for the EEPROM to be erased.

The rest of the circuit serves mainly to generate the required voltages. Here, we will require a 5-volt supply voltage and an adjustable programming voltage in the range 12 to 14 volts.

The unstabilized supply voltage comes from a battery eliminator. We recommend one because it is less costly and safer to use than a dedicated mains transformer. However, some extra circuitry is required in this case to enable stabilized voltages greater than 12 V to be gener-

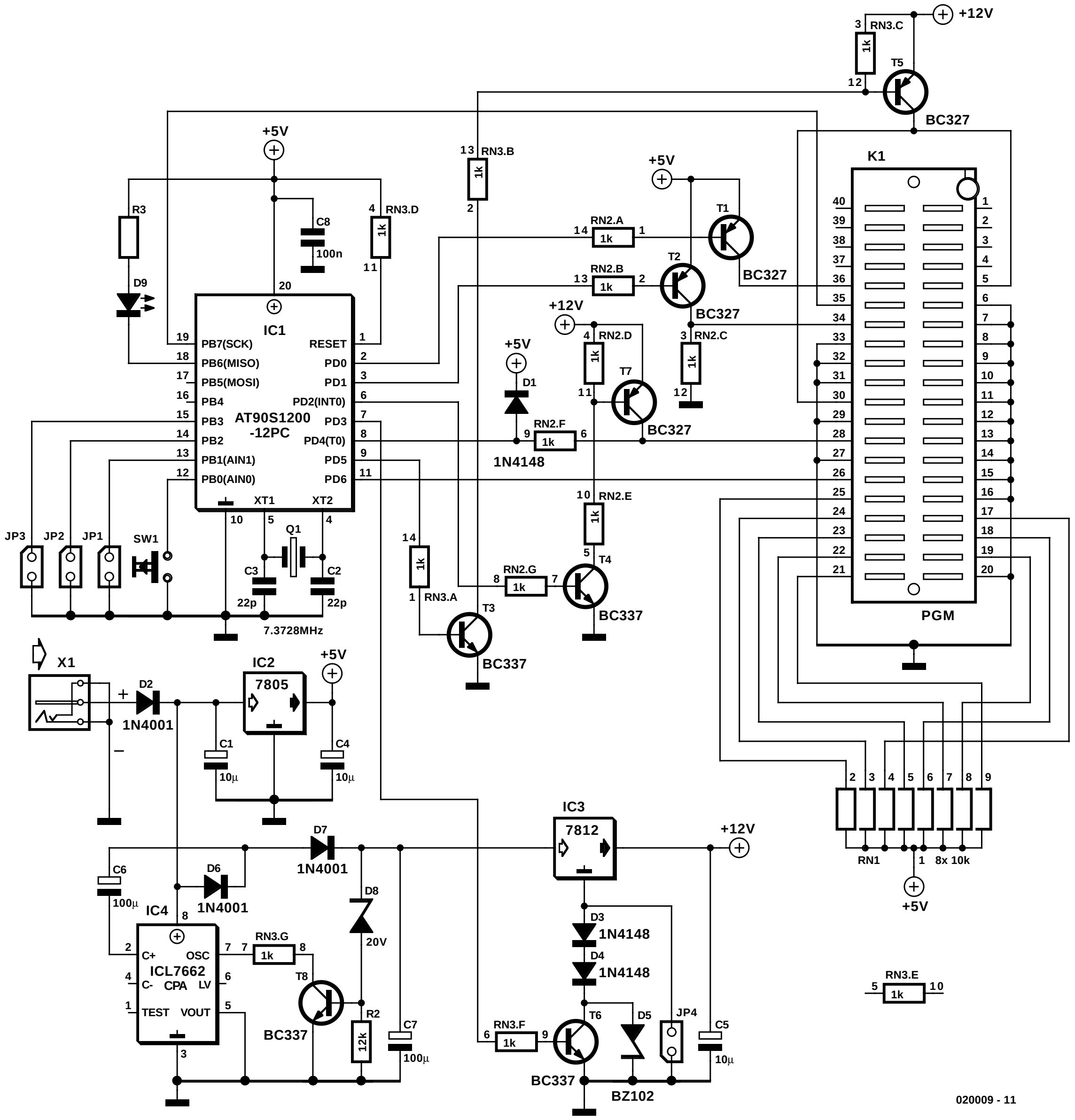


Figure 1. Circuit diagram of the hed.eraser for EEPROMs (board only available from HED, Germany).

ated whilst relying on a cheap mains adapter.

On the eraser board, the input voltage is doubled with the aid of a ICL7662CPA. Because the actual output voltage of a cheap mains adaptor is unpredictable to say the least, it makes sense to add a 20-volts voltage limiter. This is achieved with the aid of zener diode, D8, resistors R2 and transistor T8. The resulting 'raw' voltage has a maximum variation of about 1 volt and can be loaded with 25 mA. If the voltage doubler output voltage rises above the zener voltage, T8 is switched hard, causing the oscillator in IC4 to be stopped. When the voltage returns to the safe range, T8 is switched off and the oscillator is enabled again. By choosing a suitable zener diode, any voltage can be defined within a certain range.

The 'fine' adjustment of the programming voltage is handled by a 7812 voltage regulator. Three diodes, D3, D4 and D5, jack up the 7812 output voltage to three discrete levels between about 12.75 V and 14 V. Although the BZ102 diode may be found under 'Zener Diodes' in your favourite electronics catalogue, in fact, it consists of two ordinary diodes connected in series. And they can be replaced by the same! With EEPROMs requiring exactly 12.0 V for their programming voltage, the diodes may be shorted out by fitting JP4.

Practical use

Building the circuit on the printed circuit board shown in Figure 2 is a breeze and you should be able to complete it in no time at all. One of the few things to note while building the hed.eraser is that the resistor arrays, including RN1, are polarised parts so they have to be fitted the right way around.

Having finished the soldering work, the mains adaptor is set to 12 V output voltage and then connected to the socket on the hed.eraser board (+ on centre pin). Diode D2 protects the eraser against polarity reversal. The microcontroller should be left off the

What about the jumpers?

Depending on the EEPROM you need to erase, two jumpers have to be distributed across four positions.
JP1 and JP2 select the case type, while JP3 and JP4 are used to set the programming voltage level, V_{pp}.

Case	**JP1**	**JP2**
DIP28	fitted	open
DIP32	open	fitted

Vpp	**JP3**	**JP4**
12 V	open	fitted
12,5 V	fitted	open
14 V	open	open

HED also offers two adapters to allow EEPROMs in 32-way PLCC cases to be erased. Note however that SMD components of which the DIL counterpart has 32 pins (for instance, the 27C0x0), need adapter type 'PLCC32', while EEPROMs (like the 27C512) whose PLCC counterpart has 32 pins, but the DIL version, just 28 pins, have to make do with the 'PLCC32_28' adapter.

Suggested supplier

The PCB layout file (.pdf) and the software for the microcontroller (source code and HEX files) are available from this month's Free Downloads section on the Elektor Electronics website.
The author's website supplies the PCB layout as a GIF file, the hed.eraser documentation as a pdf file, as well as the source code and binaries for the microcontroller. The website also allows you to order
- a partial kit containing the programmed AT90S1200, the ICL7662CPA and the three resistor arrays
- a ready-built and tested EEPROM Eraser.

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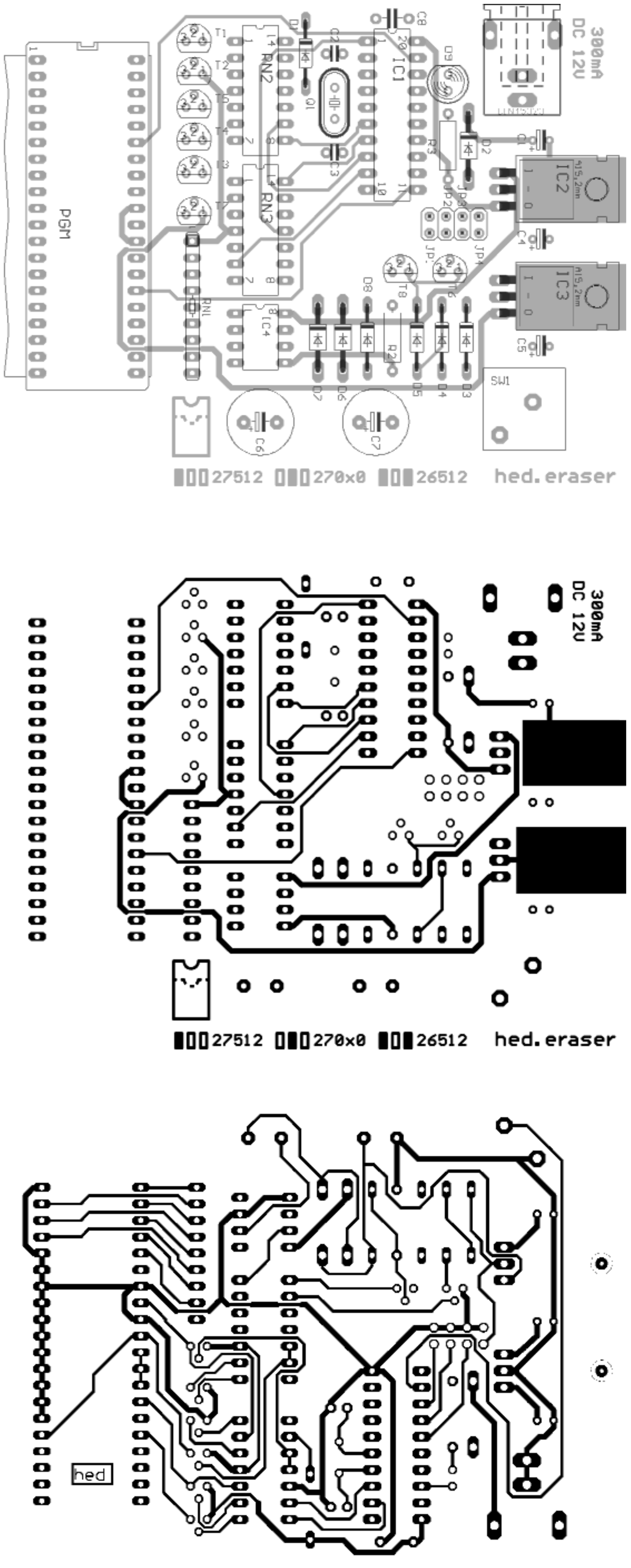

Figure 2. Copper track layout and component mounting plan of the double-sided PCB (board supplied by HED Germany).

COMPONENTS LIST

Resistors:
R2 = 12kΩ
R3 = 270Ω
RN1 = 8-way 10kΩ SIL array
RN2,RN3 = 7-way 1kΩ, DIL array

Capacitors:
C1,C4,C5 = 10µF 25V (lead pitch 2.5mm)
C2,C3 = 100nF (lead pitch 5mm)
C6,C7 = 22pF (ceramic)
C8 = 100µF 25V (lead pitch 5mm)

Semiconductors:
D1,D3,D4 = 1N4148
D2,D6,D7 = 1N4001
D5 = BZ102 (zener diode 1.4V, see text)
D8 = zener diode 20V, 500mW
D9 = LED, 5mm, green
T1,T2,T5,T7 = BC327-40
T3,T4,T6,T8 = BC337-40
IC1 = AT90S1200-8PC (programmed)
IC2 = 7805
IC3 = 7812
IC4 = ICL7662CPA (Intersil)

Miscellaneous:
X1 = 7.3MHz quartz crystal
8-way pinheader with 2 jumpers
S1 = pushbutton, 1 make contact (ITW)
2-way IC socket
40-way ZIF socket
K1 = mains adaptor socket, PCB mount

board while running a quick test of the supply voltages. The following can be measured against ground:

- Socket IC1, pin 20: +5 V ±0.1 V
- 7812 input , pin 1: +20V ±1 V
- 7812 output, pin 3: +14 V ±0.5 V

If this appears to be in order, the supply voltage may be removed and the microcontroller inserted in its socket. If the circuit is powered up again, the green LED should flash twice, and then remain on. This is a sign that the microcontroller is working and the hed.eraser is ready for use.

The hed.eraser is ‘matched’ to the EEPROM to be handled by setting a few jumpers (**Table 1**). Once the jumpers have been set to the required configuration, the EEPROM may be inserted in the ZIF socket and the ‘erase’ button may be pressed. The LED will be off during the erasure process, which lasts a couple of seconds.

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Useful literature:

ICL7662CPA Datasheets
www.intersil.com/data/fn/fn3/fn3181/fn3181.pdf

Electrically Erasable PROM (EEPROM) datasheets
SST: *www.ssti.com* (SST27SFxxx Series)
Winbond: *www.winbond.com.tw*, go to ‘Products’ then ‘EPROMs’